

C L A I M S

1. A vertical heat-processing apparatus comprising a vertical heat-processing furnace having a furnace port; a lid movable up and down to open and close the furnace port; and a rotation mechanism disposed on the lid to rotate a holder that holds a number of target substrates,

the rotation mechanism comprising a rotary shaft, and a support unit that supports the rotary shaft rotatably through a bearing and a sealing member, wherein the rotary shaft has a hollow structure with a thin wall, and is supplied with a cooling gas to flow inside and outside the rotary shaft, and the support unit has a cooling passage surrounding an upper portion of the rotary shaft, and is supplied with a coolant to flow through the cooling passage.

2. The vertical heat-processing apparatus according to claim 1, wherein the rotary shaft has an interior divided into upper and lower portions by a partition wall, near which the sealing member is disposed outside the rotary shaft, such that the cooling gas flows inside and outside the rotary shaft above the partition wall, while the lower portion of the interior of the rotary shaft below the partition wall is opened outside.

3. The vertical heat-processing apparatus according to claim 1, wherein a clearance gap between

the rotary shaft and the support unit is set small, and at least one of opposite surfaces of the support unit and the rotary shaft is provided with recesses or projections for heat-radiation.

5 4. The vertical heat-processing apparatus according to claim 1, wherein the cooling passage is helical.

10 5. The vertical heat-processing apparatus according to claim 1, wherein the cooling passage comprises a plurality of stages separated in a vertical direction by a partition member, in which communication holes are formed to allow a coolant to pass therethrough.

15 6. The vertical heat-processing apparatus according to claim 1, wherein the rotary shaft has a top end provided with a flat portion to which a turntable is fixed, and at least one of the flat portion and the turntable is provided with a recess formed therein to reduce an contact area therebetween.

20 7. The vertical heat-processing apparatus according to claim 1, wherein a turntable is connected to a top end of the rotary shaft and is rotatable on the lid, such that between a top of the lid and a bottom of the turntable is a clearance gap for an inactive gas to flow from a center to a periphery, and an annular gas buffer for pooling the inactive gas.

8. A vertical heat-processing apparatus, which

simultaneously subjects a plurality of target substrates to a heat-process, the apparatus comprising:

an airtight process chamber configured to accommodate the target substrates, and having a load port at a bottom;

5 a lid selectively open and close the load port of the process chamber;

a holder configured to hold the target substrates stacked at intervals within the process chamber;

10 a supply section configured to supply a process gas into the process chamber;

an exhaust section configured to exhaust the process chamber;

15 a heater configured to heat an atmosphere inside the process chamber;

an elevator configured to move the lid up and down along with the holder mounted thereon and holding the target substrates;

20 a rotation mechanism disposed on the lid to rotate the holder, the rotation mechanism comprising a rotary shaft having a hollow structure with a thin wall, and a support unit that supports the rotary shaft rotatably through a bearing and a sealing member, wherein an inner gas passage for cooling is formed inside the 25 rotary shaft, while an outer gas passage for cooling is formed between the rotary shaft and the support unit; and

an inactive gas supply section configured to supply an inactive gas for cooling into the inner gas passage and the outer gas passage.

9. The vertical heat-processing apparatus
5 according to claim 8, wherein the rotary shaft has an interior divided into upper and lower portions by a partition wall, near which the sealing member is disposed outside the rotary shaft, such that the inner gas passage and the outer gas passage are formed above
10 the partition wall, while the lower portion of the interior of the rotary shaft below the partition wall is opened outside.

10. The vertical heat-processing apparatus
according to claim 8, wherein, within a region where
15 the outer gas passage is formed, the rotary shaft is provided with projections or recesses for heat-radiation formed on an outer surface.

11. The vertical heat-processing apparatus
according to claim 8, wherein the rotation mechanism
20 further comprises a turntable connected to a top end of the rotary shaft, such that the turntable and the lid face each other between which a small clearance gap and an annular gas buffer connected to the small clearance gap are interposed, and wherein the rotary
25 shaft is arranged such that the inactive gas passes through the inner gas passage and the outer gas passage, and then flows through the small clearance

gap into the gas buffer.

12. The vertical heat-processing apparatus according to claim 8, further comprising a cooling passage formed in the support unit around the outer 5 gas passage to allow a coolant to flow therethrough, and a coolant supply section configured to supply the coolant into the cooling passage.

13. The vertical heat-processing apparatus according to claim 12, wherein the cooling passage is 10 helical.

14. The vertical heat-processing apparatus according to claim 12, wherein the cooling passage comprises a plurality of stages separated in a vertical direction by a partition member, in which communication holes are formed to allow a coolant to pass 15 therethrough.

15. The vertical heat-processing apparatus according to claim 12, within a region where the cooling passage is formed, at least one of opposite 20 surfaces of the rotary shaft and the support unit is provided with projections or recesses for heat-radiation.